# Summary of "Hospitalization for Community-Acquired Pneumonia in Alberta First Nations Aboriginals Compared to Non-First Nations Albertans"

By T.J. Marrie, K.C. Carrière, Y. Jin, and D. Johnson

First Nations group.

- The costs per hospital admission for First Nations Aboriginals were ninety-four percent of the average cost of the matched non-First Nations group ($4,206).

**Conclusions**

The frequency of hospitalization for community-acquired pneumonia is about five times greater for First Nations Aboriginals compared to an age-sex matched non-First Nations Aboriginal group. It appeared unlikely that the high rate of hospitalizations in the First Nations Aboriginals was due to a more severe pneumonia or greater frequency of other diseases. Due to the higher rates of hospitalization and subsequent re-hospitalization, hospital costs for community-acquired pneumonia in the First Nations Aboriginals was much higher than those of an age-sex matched non-First Nations group. Understanding the underlying reasons and possible remedies for the high frequency of hospitalizations is important. Given the concentration of First Nations Aboriginal hospitalizations in a few hospitals, a local program may be helpful. For example, others have shown a public health program for pneumococcal vaccination in Aboriginals is effective in decreasing subsequent hospitalizations.

**For more information**

Copies of the report are available from the

**Alberta Centre for Health Services Utilization Research**

- by contacting David Johnson by e-mail at cujecjohnson@shaw.ca
- at http://www.health.gov.ab.ca/system/key/Research/achsur_reports.html

**Alberta Centre for Health Service Utilization Research**

The Alberta Centre for Health Services Utilization Research is a joint initiative between the University of Alberta and the University of Calgary, funded by Alberta Health and Wellness. The Centre conducts studies of how health services are used and delivered to inform health policy development and management of health services delivery.

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**By T.J. Marrie, K.C. Carrière, Y. Jin, and D. Johnson**

**Purpose**

Respiratory illness is the fourth leading cause of death among Canadian Aboriginals. Pneumonia is one of the most common reasons for hospitalization in the North American Aboriginal community, accounting for four percent of total hospital admissions. This study determined the frequency and costs of hospitalization for community-acquired pneumonia in the Alberta First Nations Aboriginal population.

**Approach**

Alberta administrative hospital abstracts from April 1,1997 to March 31, 1999 were analyzed and each First Nations Aboriginal person with pneumonia was matched by age and sex with three non-First Nations persons with pneumonia. Aboriginals identified by the Federal Department of Indian and Northern Affairs are referred to as First Nations Aboriginals.

**Key findings**

The following are the key findings of this study:

- During the two study years, there were 18,515 acute care hospitalizations (1,230 in the First Nations Aboriginal group).
- Ten hospitals accounted for fifty-two percent of all First Nations Aboriginal patient hospitalizations with one hospital accounting for 11.5 percent of hospitalizations.
- After adjusting for differences in age and sex, the First Nations Aboriginal hospitalization rate per 1,000 was 22 compared to 4.4 for the general Alberta population.
- Aboriginals hospitalized for community-acquired pneumonia were more likely to reside in a non-metropolitan region (not Calgary or Edmonton), were younger, were mostly females, had fewer other diseases except for diabetes, and had less severe pneumonia.
- Length of hospital stay for First Nations Aboriginals was two days shorter than that for non-First Nations Aboriginals.
- After accounting for frequency of other diseases and severity of pneumonia, in-hospital mortality and hospital length of stay were lower in First Nations Aboriginals compared to the matched non-First Nations group.
- The odds for thirty day hospital re-admission were forty-two percent higher in First Nations Aboriginals compared to the non

## HOSPITALIZATION FOR COMMUNITY-ACQUIRED PNEUMONIA IN ALBERTA FIRST NATIONS ABORIGINALS COMPARED TO NON-FIRST NATIONS ALBERTANS

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      v. Findings ☐
      vi. Discussion ☐
      vii. Recommendations ☐

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3. The findings were presented clearly.

   Yes ☐ No ☐

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   Yes ☐ No ☐

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# Hospitalization for Community-Acquired Pneumonia in Alberta First Nations Aboriginals Compared to Non-First Nations Albertans

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## SUMMARY

We compared the rates and outcomes of hospital admission for community-acquired pneumonia between First Nations Aboriginal and non-First Nations groups. Alberta administrative hospital abstracts from April 1, 1997 to March 31, 1999 were analyzed and each First Nations Aboriginal person with pneumonia case was matched by age and sex with three non-First Nations persons with pneumonia. The First Nations Aboriginal hospital discharge rate per one thousand was twenty-two (95 percent CI 20.7-23.6) compared to 4.4 (95 percent CI 4.4-4.5) for the general Alberta population. After accounting for comorbidity and severity of pneumonia, in-hospital mortality and hospital length of stay were lower (odds ratio 0.49 95 percent CI 0.37-0.66 and 0.87 95 percent CI 0.79-0.97, respectively) in First Nations Aboriginals compared to the matched non-First Nations group. The odds for thirty-day hospital readmission were higher (Odds Ratio = 1.42 95 percent CI 1.21-1.68) in First Nations Aboriginals compared to the non-First Nations group. The costs per hospital admission for First Nations Aboriginals were ninety-four percent of the average cost of the matched non-First Nations group ($4,206). However, their median daily costs were 1.25 times higher (95 percent CI 1.14 -1.36 ) than the matched non-First Nations group. We concluded that it appeared unlikely that the high rate of hospitalizations in the First Nations Aboriginals is due to a more severe pneumonia or greater comorbidity. Due to the higher rates of hospitalization and subsequent re-hospitalization, hospital costs for community-acquired pneumonia in the First Nation Aboriginals was much higher than those of an age and sex matched non-First Nations group.

## INTRODUCTION

Respiratory illness is the fourth leading cause of death among Canadian Aboriginals [1]. Pneumonia is one of the most common reasons for hospitalization in the North American Aboriginal community accounting for four percent of total hospital admissions [2]. The reasons for the high rate of pneumonia hospitalization in Aboriginals are speculative. Predisposition to specific organisms may be indicated by the high rate of pneumococcal pneumonia and a high case fatality rate in some groups of Aboriginals [3]. Other factors may be low immunization rates [4, 5], high prevalence of alcoholism leading to aspiration [4], or lack of access to timely care [6]. The rate of hospitalization for pneumonia in Aboriginals may also be related to their lower socio-economic status [6, 7]. Low socio-economic status may result in greater severity of illness and the need for hospitalization [8]. Other explanatory factors may be difficulties due to long travel distances resulting in a lower threshold for admission [9, 10].

The designation of racial origin in Canadian administrative data are limited. Aboriginals identified by the Federal Department of Indian and Northern Affairs are referred to as status or First Nations Aboriginals and were identified in administrative data. In this study we compared the course of hospitalization for community-acquired pneumonia between First Nations Aboriginal and an age-sex matched group of non-First Nations Albertans. We hypothesized that the frequency and outcomes of hospitalizations for community-acquired pneumonia in the First Nations Aboriginal differed from the matched non-First Nations group.

## METHODS

Two administrative health service databases were used and the analysis was done within the protected environment of Alberta Health and Wellness, which is governed by provincial legislative guidelines on the confidentiality of health information. These data capture nearly the entire population and included a unique anonymous personal identifier allowing linkage between data bases. The data bases were:

1. Canadian Institute for Health Information's (CIHI) Inpatient Discharge Abstract Database (DAD) for the province of Alberta for 1997/1998 to 1998/1999, and
2. Alberta Health Insurance Plan Registry File for 1997 to 2000.

Community-acquired pneumonia was defined as the most responsible diagnosis (MRD) or any of the other fifteen diagnosis codes defined to be Type 1 (pre-admit comorbidity) with the ICD-9-CM values of 480.x to 487.x (pneumonia) or 507.x (aspiration pneumonia) excluding 484.x (pneumonia of infectious diseases classified elsewhere) [11, 12] found in CIHI DAD.

### Exclusion Criteria:

1. Not an Alberta resident or not treated in an Alberta acute care facility,
2. Adjacent diagnosis related group (ADRG) defining hospitalization for a surgical procedure, and
3. Any previous hospitalization within ten days of incident pneumonia case.

### Identifying First Nations Aboriginal Status:

First Nations status (recorded as federal band registry identification with the Department of Indian and Northern Affairs) were recorded in the Alberta Health Insurance Registry databank, which was then linked to hospital abstracts. The comparison group for the population was created by matching each First Nations hospitalization by age, sex and year of the hospitalization to a non-First Nations pneumonia case. We used three controls for each First Nations Aboriginal case.

Length of stay was calculated as days between discharge and admission date. Transfers were attributed to the index admission and cumulative hospital length of stay calculated. Alternate level of care referred to patients who remained in hospital but no longer required acute care. Alternate (not acute care) level of care days were subtracted from the length of stay. All active hospital acute care beds in each year per resident region were surveyed and maintained in the provincial databases.

**Comorbidity:**

1. Age (age at the fiscal year-end is used),
2. Gender,
3. Charlson's comorbidity index calculated using established definitions [13, 14], and
4. Alcohol-related problems (ICD-9-CM 291.x 303.x 305.x V11.3) extracted from any of the sixteen hospital abstract diagnosis fields derived solely from the hospital chart

**Severity of Pneumonia Illness, Defined:**

1. Transfer to hospital from a nursing home, long term care or continuing care institution,
2. Transfer from another acute care facility as defined by readmission to hospital for the diagnosis of pneumonia within forty eight hours of previous discharge,
3. Special care unit admission (defined by each hospital),
4. Diagnosis code of respiratory failure or arrest (ICD-9-CM 518.81, 799.1),
5. Diagnosis code of hypotension or shock (ICD-9-CM 458.xx, 785.5x),
6. Procedure code for ventilation greater than ninety-six hours (ICD-9-CM 96.72), and
7. Procedure code for dialysis (ICD-9-CM 39.95, 54.98).

**Defining Hospital Type by Patient Volume:**

Hospitals admitting patients with community-acquired pneumonia were categorized into five groups on the basis of the average number of hospital discharges per year over the five year study period, geographic location, and medical school proximity:

**Rural**

- Less than fifty cases per year comprising seventy-seven hospitals;
- Fifty to 108 cases per year comprising twenty-seven hospitals;

The rural hospital cut-off values for pneumonia cases of 50 and 108 represented the 50$^{th}$ and 75$^{th}$ percentiles of the volume of pneumonia cases in all Alberta patients.

**Regional**

- Five hospitals located in one of the five non-metropolitan regional health care cities ranging from 67 to 251 cases per year and one high volume rural hospital accounting for 221 cases per year;

**Metropolitan**

- Seven hospitals located in the metropolitan health regions of Calgary and Capital hospitals ranging from 92 to 813 cases per year;
- Two hospitals located adjacent to medical schools with one hospital in each of two metropolitan centres ranging from 493 and 610 cases per year.

### Calculating Distance:

Each case was mapped to the centre of a postal code and distances as the "crow flies" between centroids calculated. Nearest hospital and actual admitting hospital distances to resident postal code were obtained for all non-urban residents (not residing in Calgary or Edmonton health regions). Urban resident distances were zero.

### Hospital Costs:

Inpatient cost per resource group number (RGN) was calculated using the provincially approved methodology [15, 16]. Total costs combine direct and indirect costs associated with an inpatient hospitalization from the time a patient was admitted to the hospital to the time of discharge. All costs were estimated in 1998/1999 and assumed similar for all the study years. The quality of the data reporting of costs in Alberta has been highly ranked by the Canadian Institutes for Health Information [17] avoiding methodological issues that arise around collection of cost data in the United States of America [18] in part due to the use of prices rather than costs.

### Outcomes Were Defined as:

1. Hospital discharge rate for the First Nations Aboriginal and matched non-First Nations group;
2. Length of hospital stay per hospital discharge;
3. Any re-hospitalization between zero to thirty days after index pneumonia date hospital discharge excluding re-hospitalization for pneumonia between zero to two days (considered to be a hospital transfer); and
4. Median daily hospital cost per hospital discharge.

## STATISTICS

Age-sex adjusted provincial hospital discharge rates and their ninety-five percent confidence intervals were calculated. The indirect standardization method was used using the two-year average, age-sex specific rates as the standard rates (eighteen to thirty-four years old, ten-year increment afterwards up to seventy-four years old, seventy-five and over for each sex). In order to calculate standard error for the standardized rates, patient's age at a fixed date was necessary as a patient may have had more than one separation in a year. Age at the fiscal year-end was used for the rates. Separations rates were compared using the T-statistic [19]. If the T-statistic was significant, individual rate differences were compared using the overall ninety-five percent confidence interval after adjusting for multiple comparisons.

To analyze the case-control data, we used the conditional logistic analysis tool, LogXact V. 2.0 (1996) by Cytel Software Corporation, Cambridge, MA., USA. We dichotomized the data on continuous outcomes (costs and length of stay) using their median.

Covariates were age, sex, year of hospitalization, per capita number of acute care beds per resident region in each study year, hospital type as defined above, exported case (i.e. service region not equal to recipient region), urban or non-urban resident region, urban or non-urban service region, nursing home transfer to hospital, transfer to another hospital, special / intensive care unit admission, diagnosis code of respiratory failure / arrest, diagnosis code of hypotension / shock, procedure code for ventilation greater than ninety-six hours, procedure code for dialysis, and number of comorbid diagnosis (0, 1, 2, > 2). Significance was defined as $p < 0.05$.

## RESULTS

During the two years of the study there were 1,230 First Nations Aboriginal hospitalizations for 976 unique patients and 3,691 non-First Nations hospitalizations for 3,581 unique patients. Compared to the overall non-First Nations group, First Nations Aboriginals (Table 1) admitted to hospital with community-acquired pneumonia were more likely to reside in a rural region and were more likely to be hospitalized in a small rural hospital. The frequency of comorbidity in the two groups was similar but the case mix was different (i.e. more diabetes and less malignancy in the First Nations Aboriginals). First Nations Aboriginals had less severe pneumonia (measured by frequency of admission to special / intensive care unit, hypotension / shock, respiratory failure / arrest, ventilation for greater than ninety-six hours). More First Nations Aboriginals resided in a rural region and rural First Nations Aboriginals traveled a greater distance to a hospital compared to other rural residents (Table 2). More rural First Nations Aboriginals had services provided in a health region different from their region of residence and more were transferred to another acute care hospital after the initial hospital admission.

The First Nations Aboriginal hospital discharge rate for community-acquired pneumonia was five times greater than the Alberta provincial average (Table 3). The First Nations Aboriginals alcohol related problems were twice the non-First Nations group rate. The First Nations Aboriginals hospital discharge rate for aspiration pneumonia was also five times greater than the Alberta population rate but, the proportion of aspiration pneumonia to all pneumonia was similar in both groups. Length of hospital stay for First Nations Aboriginals was nearly two days shorter than non-First Nations group. The rate of all cause readmissions by First Nations Aboriginals was about twenty-five percent greater that of the non-First Nations group (Table 4). The average hospital cost per day was greater in First Nations Aboriginals. Cumulatively, one hospital accounted for 11.5 percent of discharges, two hospitals accounted for twenty percent, and ten hospitals accounted for fifty-two percent.

After accounting for comorbidity and severity of pneumonia (Table 5), in-hospital mortality and hospital length of stay were lower (odds ratio 0.49 95 percent CI 0.37-0.66 and odds ratio 0.87 95 percent CI 0.79-0.97) in First Nations Aboriginals compared to

the matched non-First Nations group. The odds for thirty-day hospital readmission were higher (odds ratio = 1.42 95 percent CI 1.21-1.68) in First Nations Aboriginals compared to the non-First Nations group.

## DISCUSSION

The hospital discharge rate for community-acquired pneumonia is about five times greater in First Nations Aboriginals compared to the Alberta population. It is unlikely that the high rate of hospitalizations in First Nations Aboriginals is due to more severe pneumonia as clinically these hospitalizations were shorter in length and involved less specialized medical care (such as special / intensive care unit admission and mechanical ventilation greater than ninety-six hours). After adjustment (see regression methods), in-hospital mortality was lower in the First Nations Aboriginals. As well, it is unlikely that the high rate of hospitalizations in First Nations Aboriginals was due to a generally unhealthy population, as their comorbidity was similar to the matched non-First Nations group. The cost per hospital admission for First Nations Aboriginals was ninety-four percent of the average cost of the matched non-First Nations group (Can $4,206). However, their daily average cost was 1.25 higher (95 percent CI 1.14 -1.36) than the matched non-First Nations.

The greatest morbidity and mortality burden for pneumonia falls disproportionately on the elderly [23-25]. First Nations Aboriginals hospitalized for community-acquired pneumonia were younger than the Albertan population hospitalized for community-acquired pneumonia [26]. We used age and sex matched cases in the modeling in order to minimize differences in the two populations. The non-First Nations group were more likely to have an urban residence compared to First Nations Aboriginals. Rural First Nations Aboriginals were located at a farther distance from their local hospital compared to rural non-First Nations group. Physicians may have been more likely to admit patients who did not reside in close proximity to the admitting hospital [9, 10]. However, greater distance to the local hospital does not account for greater frequency of transfer to another acute care hospital (despite less comorbidity and severity of illness). As well, thirty-one percent of rural First Nations Aboriginals were admitted to a service region different from their resident region; over twice the frequency of the rural non-First Nations group. The distribution of utilized hospitals demonstrate that despite their more non-urban residency, rural First Nations Aboriginals were admitted to urban hospitals more frequently than other rural non-First Nations group. Thus, not only did the rate of hospitalization differ in First Nations Aboriginal population, the location of the hospital with respect to residence was also different. First Nations Aboriginals have many other important differences from non-First Nations Albertans [27]. Alcohol / substance abuse, smoking [28, 29], diabetes [30, 31], and end-stage chronic renal failure are more common in First Nations Aboriginals [32]. In this study, we controlled for other comorbidity, aspiration pneumonia (related to substance abuse) was

not proportionally more prevalent, and chronic obstructive pulmonary disease (as related to smoking) was not more frequent in First Nations Aboriginals.

The Aboriginal population was not considered a homogenous group as they were composed of First Nations people registered with the Department of Indian and Northern Affairs (DIAND), non-registered Aboriginals, Metis, and Inuit. The proportion of First Nations people registered with DIAND living off reserve has increased from twenty-nine percent in 1982 to forty-two percent in 1997 [6, 7]. The 2001 census states that the population with Aboriginal origin was 156,000 [33]. In 2001, census data indicates there were about 55,000 First Nation Aboriginals over the age of fifteen years [33]. In 1997/1998 there were 54,730 First Nations Aboriginals eighteen years and over registered with the Department of Indian Affairs and linked to an Alberta personal health number identification.

There are a number of limitations to this study. First Nations Aboriginals registered with DIAND may not be reflective of Aboriginals without registration. The place of residence for First Nations Aboriginals may be more related to band location rather than actual domicile. Systematic under-reporting of out-of-hospital death in First Nations Aboriginals may result in an overestimation of those at risk and an underestimation of pneumonia rates. These limitations underscore why secondary use of administrative data should be interpreted with caution. Population-based administrative database research is highly generalizable although limited in clinical detail. We attempted to adjust for case severity (hypotension / shock, respiratory arrest / failure, ventilation, special care unit admission, export to another region, transfer to another hospital) and case mix (comorbidity, transfer from nursing home, age, sex) but may not have captured all variation [36]. These variables are likely less reliable than a clinically derived pneumonia index [37]. Individual data about the use of influenza and pneumococcal vaccine was unavailable. In particular, influenza vaccine has been shown to reduce the hospitalization rate for pneumonia [38] and its use was lower in Aboriginals [4, 5].

In conclusion, it is unlikely that the high rate of hospitalizations in the First Nations Aboriginals is due to a more severe pneumonia or having more comorbidity. Due to the higher rates of hospitalization and subsequent re-hospitalization, hospital costs for community-acquired pneumonia in First Nations Aboriginals was greater than the non-First Nations group. In this light, understanding the underlying reasons and possible remedies is important. Given the concentration of First Nations Aboriginal hospitalizations in a few hospitals, local efforts may be helpful. For example, a high rate of pneumococcal pneumonia in First Nations Aboriginal admitted to these hospitals may support a local public health program of universal pneumococcal vaccination[39]. With a mean age of fifty-three years most of the First Nations patients who require admission to hospital for the treatment of pneumonia would not qualify for pneumococcal vaccine under the program in Alberta which recommends vaccination for all adults sixty-five years of age and older.

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**Table 1 – Description of All Hospital Discharges for Community-Acquired Pneumonia (Number and Percent) in First Nations Aboriginals and an age and sex Matched Non-First Nations Group**

| | First Nations Aboriginal hospital discharges n = 1,230 | Age-sex matched non- First Nations hospital discharges n = 3,690 |
|---|---|---|
| Mean age in years (std) | 53.5 (19.5) | 53.7 (19.4) |
| Females | 689 (56.0%) | 2,067 (56.0%) |
| Transfer to hospital from a nursing home, long term care or continuing care | 4 (0.3%) | 89 (2.4%) |
| Transfer to another acute hospital | 36 (2.9%) | 78 (2.1%) |
| Urban resident region | 218 (17.7%) | 1,672 (45.3%) |
| Urban service region | 299 (24.3%) | 1,678 (45.5%) |
| Admitted to a hospital not located in home region | 352 (28.6%) | 404 (10.9%) |
| Patient designated as no longer acute care (alternate level of care) | 7 (0.6%) | 34 (0.9%) |
| Hospitals | | |
| Less than fifty cases per year | 321 (26.1%) | 741 (20.1%) |
| Fifty to one hundred and eight cases per year | 387 (31.5%) | 767 (20.8%) |
| Regional hospitals | 223 (18.1%) | 504 (13.7%) |
| Metropolitan | 191 (15.5%) | 1,152 (31.2%) |
| Metropolitan in proximity to a medical school | 108 (8.8%) | 526 (14.3%) |
| **Comorbidity** | | |
| None | 607 (49.3%) | 1,795 (48.6%) |
| One | 408 (33.2%) | 1,193 (32.3%) |
| Two | 154 (12.5%) | 484 (13.1%) |
| More than two | 61 (5.0%) | 218 (5.9%) |
| Chronic obstructive pulmonary disease | 310 (25.2%) | 1,040 (28.2%) |
| Diabetes | 181 (14.7%) | 379 (10.3%) |
| Malignancy | 35 (2.8%) | 254 (6.9%) |
| Congestive heart failure | 137 (11.1%) | 374 (10.1%) |
| Vascular (acute myocardial infarction, peripheral vascular disease, cerebral vascular disease) | 73 (5.9%) | 311 (8.4%) |
| Alcohol problem recorded on hospital abstract | 244 (19.8%) | 369 (10.0%) |
| **Severity of illness** | | |
| Special / intensive care unit admissions | 72 (5.9%) | 295 (8.0%) |
| Hypotension / shock | 17 (1.4%) | 77 (2.1%) |
| Respiratory arrest / failure | 32 (2.6%) | 166 (4.5%) |
| Ventilation for more than 96 hours | 9 (0.7%) | 59 (1.6%) |
| In-hospital dialysis | 14 (1.1%) | 34 (0.9%) |

**Table 2 – Description of Community-Acquired Pneumonia (Number and Percent) for Non-Urban Residents Only in First Nations Aboriginals and a Matched Non- First Nations Group**

| | First Nations Aboriginals hospital discharges n = 1,012 | Age-sex matched non-First Nations hospital discharges n = 2,018 |
|---|---|---|
| Mean distance (km) to closest hospital | 21 | 6 |
| Mean distance (km) to admitting hospital | 40 | 19 |
| Transfer to another acute hospital | 31 (3.1%) | 52 (2.6%) |
| Admitted to an out of region hospital home region | 314 (31.0%) | 275 (13.6%) |
| **Hospitals** | | |
| Less than fifty cases per year | 307 (30.3%) | 672 (33.3%) |
| Fifty to one hundred and eight cases per year | 372 (36.8%) | 735 (36.4%) |
| Regional hospitals | 217 (21.4%) | 483 (23.9%) |
| Metropolitan | 60 (5.9%) | 76 (3.8%) |
| Metropolitan in proximity to a medical school | 56 (5.5%) | 52 (2.6%) |

**Table 3 – Age-Sex Adjusted Rates for Community-Acquired Pneumonia in Alberta During April 1, 1997 to March 31, 1999**

| | First Nations Aboriginal patients n = 976 | All Alberta patients n = 16,528 |
|---|---|---|
| Age-sex adjusted hospital discharge rate for community-acquired pneumonia per 1,000 population (95% CI) | 22.1 (20.7-23.6) | 4.4 ( 4.4-4.5) |
| Age-sex adjusted hospital discharge rate for aspiration pneumonia per one thousand population (95% CI) | 1.29 (0.96-1.6) | 0.27 (0.26-0.29) |

**Table 4 – Outcomes for Community-Acquired Pneumonia (Number and Percent) in First Nations Aboriginals and a Matched Non- First Nations Group**

| | First Nations Aboriginals hospital discharges n = 1,230 | Age-sex matched non- First Nations hospital discharges n = 3,691 |
|---|---|---|
| Mean (standard deviation)<br>Median length of stay in days | 6.1 (8.5)<br>4 | 7.8 (13.7)<br>5 |
| In-hospital mortality | 38 (3.1%) | 255 (6.9%) |
| * All cause thirty-day readmissions | 260 (21.8%) | 508 (14.8%) |
| * Readmission with a second pneumonia within two to ten days of discharge | 38 (3.2%) | 59 (1.7%) |
| * Readmission with a second pneumonia within eleven to thirty days of discharge | 43 (3.6%) | 46 (1.3%) |
| Average costs (in 1998/1999 dollars) per separation | $3,946 | $4,206 |
| Average daily costs (in 1998/1999 dollars) per discharge | $1,088 | $949 |

* Note that denominator eliminates hospital death

**Table 5a – Conditional logistic regression analysis for hospital death in First Nations Aboriginals and a matched Non-First Nations group**

| | Odds Ratio | 95% Confidence Interval |
|---|---|---|
| First Nations Aboriginals | 0.49 | 0.37 - 0.66 |
| Comorbidity (0) | Reference | |
| Comorbidity (1) | 1.53 | 1.12 - 2.09 |
| Comorbidity (2) | 3.42 | 2.51 - 4.66 |
| Comorbidity (>2) | 4.78 | 3.16 - 7.23 |
| Special care unit admission | 2.07 | 1.52 - 2.81 |
| Transfer from nursing home | 2.67 | 1.72 - 4.14 |
| Respiratory failure / arrest | 4.39 | 3.27 - 5.89 |
| Hypotension / shock | 4.40 | 2.39 - 8.07 |

**Table 5b – Conditional Logistic Regression Analysis for any Re-Hospitalization Between Zero to Thirty Days After Index Pneumonia Date Separation in First Nations Aboriginals and a Matched Non-First Nations Group**

| | Odds Ratio | 95% Confidence Interval |
|---|---|---|
| First Nations Aboriginals | 1.42 | 1.21 - 1.68 |
| Comorbidity (0) | Reference | |
| Comorbidity (1) | 1.50 | 1.23 - 1.83 |
| Comorbidity (2) | 2.07 | 1.59 - 2.68 |
| Comorbidity (>2) | 2.05 | 1.45 - 2.89 |
| Special care unit admission | 1.34 | 1.00 - 1.80 |
| Respiratory failure / arrest | 1.74 | 1.06 - 2.87 |
| Hospital (less than fifty cases per year) | Reference | |
| Hospital (fifty to one hundred and eight cases per year) | 1.02 | 0.80 - 1.30 |
| Regional hospitals | 1.25 | 0.94 - 1.66 |
| Metropolitan hospitals | 0.77 | 0.60 - 0.99 |
| Metropolitan hospitals in proximity to a medical school | 0.98 | 0.74 - 1.30 |

**Table 5c – Conditional Logistic Regression Analysis for Hospital Length of Stay * Being Longer Than the Median Value of Five Days in First Nations Aboriginals and a Matched Non- First Nations Group**

| | Odds Ratio | 95% Confidence Interval |
|---|---|---|
| First Nations Aboriginals | 0.87 | 0.79 - 0.97 |
| Comorbidity (0) | Reference | |
| Comorbidity (1) | 1.20 | 1.08 - 1.34 |
| Comorbidity (2) | 1.41 | 1.21 - 1.63 |
| Comorbidity (>2) | 1.59 | 1.30 - 1.96 |
| Transfer to another hospital | 2.55 | 1.97 - 3.31 |
| Mechanical ventilation greater than 96 hours | 2.18 | 1.68 - 2.83 |
| Hospital (less than fifty cases per year) | Reference | |
| Hospital (fifty to one hundred and eight cases per year) | 1.11 | 0.96 - 1.29 |
| Regional hospitals | 1.54 | 1.31 - 1.82 |
| Metropolitan hospitals | 1.56 | 1.35 - 1.79 |
| Metropolitan hospitals in proximity to a medical school | 1.66 | 1.39 - 1.97 |

* LOS=1, if LOS > 5 days (the median LOS).

**Table 5d – Conditional Logistic Regression Analysis for Daily Hospital Cost* Being Higher Than the Median Cost of $723 in First Nations Aboriginals and a Matched Non- First Nations Group**

| | Odds Ratio | 95% Confidence Interval |
|---|---|---|
| First Nations Aboriginals | 1.25 | 1.14 - 1.36 |
| Transfer from Nursing home | 1.50 | 1.07 - 2.09 |
| Transfer to another hospital | 0.53 | 0.38 - 0.74 |
| Special care unit admission | 1.34 | 1.11 - 1.63 |
| Respiratory failure / arrest | 1.49 | 1.17 - 1.89 |
| Mechanical ventilation greater than ninety-six hours | 0.52 | 0.34 - 0.77 |

*Cost=1 if the average cost per day per separation > $722.71 (the median cost)

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